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Translation 51

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BUOYANCY OF SEA ICE

( Plovuchest' morskogo l'da )

by

V. S. Nazarov

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SNOW ICE AND PERMAFROST RESEARCH ESTABLISHMENT  
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## BUOYANCY OF SEA ICE

by  
V. S. Nazarov

Sea ice has frequently been used in recent times for transport and handling of freight, but the safe bearing capacities of the ice are not known.

Let us make a first approximation of the buoyancy of sea ice.

The buoyancy of sea ice is inversely proportional to its density, i.e., the buoyancy of sea ice decreases with increase in density. This is true only for winter ice, i.e., ice which has not been affected by melting. Ice which has been affected by melting throughout its entire mass is called spring ice. The buoyancy of spring ice is directly proportional to its density, i.e., its buoyancy increases with density. The following examples confirm this.

The density of winter ice varies from 0.900-0.924 [g/cm<sup>3</sup>]. One dm<sup>3</sup> of ice with a density of 0.900 loses its buoyancy with a load of 100 g; 1 dm<sup>3</sup> of ice with a density of 0.924 loses its buoyancy with a load of 6\*g, etc. Spring ice has densities from 0.839-0.900. The decrease in density of spring ice occurs as a result of melting and the formation inside the ice of cavities filled with water. The use of a correction factor for the volume of the water inside the ice increases the density of spring ice to 0.977-0.993, i.e., 1 dm<sup>3</sup> loses its buoyancy with a 7-g load. Movement over this type of ice or displacement of loads on its surface is not practical.

The densities of polar sea ice vary extremely, from 0.839-0.924 according to actual measurements.

The table of safe surface loading of sea ice has been calculated from these data. In using the table one must remember that it gives maximum loading values, and loads must be decreased according to the safety factor required. A 10% decrease is sufficient for stationary loads.

\*Translator's note: Should be 76.

## BUOYANCY OF SEA ICE

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Table of Safe Surface Loading of Sea Ice

Ice thickness (cm)	Load Limit (kg/m <sup>2</sup> )	
	Winter ice	Spring ice
10	7.6	0.8
20	15.2	1.6
30	22.8	2.4
40	30.4	3.2
50	38.0	4.0
60	45.6	4.8
70	53.2	5.6
80	60.8	6.4
90	68.4	7.2
100	76.0	8.0
110	83.6	8.8
120	91.2	9.6
130	98.8	10.4
140	106.4	11.2
150	114.0	12.0
160	121.6	12.8
170	129.2	13.6
180	136.8	14.4
190	144.4	15.2
200	152.0	16.0
300	228.0	24.0